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Junfang Li (jli@math.uab.edu), Department of Mathematics, University of Alabama at Birmingham, Birmingham, AL 35294, and **Xiangjin Xu*** (xxu@math.binghamton.edu), Department of Mathematical Sciences, Binghamton University-SUNY, Binghamton, NY 13902-6000. *Li-Yau type gradient estimates and monotonicity of entropy formulas on complete Riemannian manifolds with negative Ricci curvature.*

We study the new Li-Yau type gradient estimates, and new differential Harnack inequality for the positive solutions of the linear heat equation on complete Riemannian manifolds with $\text{Ricci}(M) \geq -K$ with $K \geq 0$. And we also prove that the corresponding entropy for the linear heat equation on complete Riemannian manifolds with Ricci curvature bounded from below is monotone decreasing. As applications, several parabolic Harnack inequalities are obtained and they lead to new estimates on heat kernels of manifolds with Ricci curvature bounded from below. (Received January 12, 2011)